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XXXIII. *Account of the Iron Ore lately found in Siberia.*
In a Letter to Dr. Maty, Sec. R. S. by Petr. Simon
Pallas, M. D. F. R. S.

S I R,

Peteriburg.
 Nov. 6, 1775.

R. May 16, 1776. **T**HE travels in which I have been employed, by order of our empress, since the year 1768, have interrupted the correspondence I had the pleasure to entertain with some of the Fellows of the Royal Society of London, particularly the worthy Mr. COLLINSON; and as this ingenious man, in the mean time, has left this world, I make so free as to address myself to you directly, for the leave of communicating from time to time, to the Royal Society, such observations or papers, which I am not bound to deliver to the Academy here. I would have before this observed that duty, to which the honour of being a foreign member of the Royal Society obliges me, had not the distance in which I have lived these seven years, mostly out of Europe, and the troublesome manner of travelling in these countries, together with the distractions and duties of my employment, rendered it impossible. Being now returned to a more quiet manner of living, I shall never neglect an opportunity of shewing my attachment for

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the Royal Society, as well as the highest respect to that learned Body.

I have embraced the opportunity of a parcel I sent to Mr. DRURY, to offer the Society a specimen of the native iron, of which I found out a large mass in the Siberian mountains, which actually is transporting to Petersburg. I read in some foreign journals, that a short account of this mass has been published in the last volume of Philosophical Transactions, out of a letter of the honourable M. STAEHLIN of our Academy ; but as the contents of it, drawn from the informations I gave to our Academy in my itinerary relations, seem not to have been exact, I beg leave to give you here a faithful and fuller account of the place and circumstances, in which that memorable mass was found.

It is to be observed, that in the neighbourhood of the river Jenifei, one of the largest, that runs from the South through Siberia and to the Northern Ocean, and near which the mass of native iron has been detected, there is great plenty of iron ores, as well in the flat layers towards the Northern level of the country, where, amongst others, whole banks of *ochraceous* minerals, with scattered trees and pieces of wood turned to rich iron ore, and near the town of Jenifeisk, a rich iron ore, in the form of white clay and white sparry stones, is to be found; as also in the steep mountains, where the *strata* dip very considerably, and ores of iron, copper, and even impregnated with gold, are found in veins and nests. On the mountains, that lie along the Eastern
side

side of the abovementioned rivers, from 56° to 52° of latitude, where the highest ridge of mountains begins, iron ores are most common, and the mountains generally consist of grey or black flates and shivers, which rise steeper, or in a greater angle to the horizon, as they come nearer to the high ridge of mountains, and approach more to a level position, as they extend to the North. Some of these secondary mountains are very high, rising very often to some thousand feet above the sea surface, and most of them are covered with forest. A very rich iron ore in veins was here discovered in the year 1749, on a steep, woody mountain, about ten English miles from the river Jenifei, and 180 miles from the town of Krasnojarsk, situated on that river to the Southward, about 54° of latitude, between two rivulets, known by the names of Ubei and Sifim, and running into the river on the Eastern side. This place was then visited by the Russian miners; but as there was plenty of iron ores situated much nearer to the Factories, the mine never was worked, though the ore contains above seventy pounds of iron in the hundred weight, being of a dark steel colour, turning red when rubbed, and in some parts endowed with a magnetic virtue. Upon the same mountain, where this mine is situated, on the North-side, much below the top of the mountain, the mass of native iron lay on the very ridge, without being fixed to the rock, which is a grey, stratified *saxum*. There was, on that and the neighbouring mountains, no trace of ancient miners and their kilns, which are found in many other

parts of Siberia, and in which those miners, of some former and hitherto unknown nation inhabiting these parts, mostly worked upon copper ores. Nor could so large a mass ever have been formed in the small kilns of these people, which never could yield more than 50 or 60 pounds of metal at a time; whereas this mass, in its first condition, weighed above 1680 Ruffian pounds. It is throughout of the nature you may see in the specimen which M. DRURY will deliver to you. The iron is formed in a coarse, spongy texture, mostly pure, perfectly flexible, and fit to be worked to small tools by a moderate fire; but in a more violent one, and chiefly being melted down, it becomes dry and brittle, resolves in grains, and will no more stick together, nor extend under the hammer. In its natural state, the iron itself is incrustated with a kind of varnish, which has preserved it from rust; but, wherever this is lost, or the iron bars broken, rust comes on very readily. The cavities formed by the iron are equally filled up with a kind of *fluor*, which for the most part is of a clean, transparent, amber colour, cuts glass, has none of the properties of *scoria*, and forms, according to the hollows it fills, various roundish grains or drops, very glossy and clean, on their surface, having one or more flat surfaces. This *fluor* is extremely brittle, and thus, by cutting off any part of the mass, this substance is lost, and comes off partly in grains, and partly in form of a coarse powder of vitrescent matter. The whole mass has no regularity of form, but resembles a large, oblong, somewhat flattish pebble, and is coated on the outside

with a matter resembling some blackish, brown iron ores. This coat, however, covers not the whole mass; it is also very rich of iron, and even the transparent *fluor* yields some pounds of iron in the hundred. Whoever will consider the mass itself, or large specimens of it, will not have the least doubt of its being worked by nature, since it has no one character of *scoriaceous* matters melted by artificial fire, or commonly found among volcanos.

With regard to these, as seeming a probable place where this mass could have been formed, it may not be amiss to add the following observations. The mountains, where it was found, are part of the Northern extensions of that mighty chain of mountains which runs from West to East through Asia, and forms the natural limits of Siberia, with the Desarts of Tartary, the Mongols, and the Chinese Empire. From the river Irtysh, where the forehills and lower parts of these mountains yield, in a great many places, the richest silver ores, the chain runs generally somewhat to the North-east, and therefore extends to the East of the river Jenisei, over a much greater part of Siberia than what it did before. Its forehills are almost every where composed of rocks and *strata*, rising very steep to the horizon, and the horizontal layers are only found in the level country, in which also all kinds of fossil and petrified sea productions are very scarce, and only found in the very Northern parts of Siberia. Common flint is as scarce in Siberia as petrifications, and nothing like productions of volcanoes any where to be found. Even in some places, where hot springs are found,

found, these seem only due to collections of *pyritae* of no great extent, and the slight earthquakes which are sometimes observed about the river Irtysh, and more frequently about the lake Baïkal, certainly rise in the very neighbourhood of this lake and of the Noor Saïfan, which gives rise to the river Irtysh; and about these lakes never any thing like a volcano has been heard of, nor is there one known in the Northern part of Asia, except those in Kamtschatka and the islands newly-discovered between that peninsula and the continent of North America. The same may be assured of the Urallian mountains, a ridge that runs from South to East, and continues to the very Northern Ocean and Nova Semlja, being only interrupted by the Streight of Waygat. It is this ridge of mountains that makes the natural limit between Europe and Asia, and to the East of which the largest share of true remains of elephants, rhinoceroses, and large buffaloes, is found in the banks of all the larger rivers, that run from the above-mentioned chain of mountains to the Northern Ocean, and yield such remains from the places where they reach the plains of Siberia (no such bones being ever found in the higher mountains) to the very Ocean; where the frozen earth of the Northern plains preserves these remains of Southern animals in such perfection, that when I was at Irkuzk, the head and two legs of a true rhinoceros were sent from the river Wilui, with its skin and part of the tendons preserved on them, which are now in the Museum of our Academy, and fully described

described and figured in the XVIIth volume of *Nova Commentaria Petropolitana.*

By the very first ships that will sail from this port in spring, I shall take the liberty to send you, for the Royal Society, whatever I have published since 1767, and some other curiosities for the Museum. If any particular production, or account of natural productions from these parts, should be wanted to the Society, I shall be ready to serve with whatever I am able to supply.